Aukosh S. Jagannath

Curriculum Vitae

Department of Statistics and Actuarial Science
University of Waterloo
Mathematics 3 (M3) Rm 2114
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Waterloo, ON, Canada
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Education

Ph. D. in Mathematics, New York University, May 2016
Title: Variational and structural methods in mean field spin glasses

B.A. in Mathematics and Physics, New York University, May 2011
Summa Cum Laude with highest honors in Mathematics and highest honors in Physics

Academic Positions

University of Waterloo

Canada Research Chair in Mathematical Foundations of Data Science May 2023 -
Associate Professor, Department of Statistics and Actuarial Science Jul 2024 -
Assistant Professor, Department of Statistics and Actuarial Science Jul 2019 - Jun 2024
Cross-appointments: Department of Applied Mathematics, Cheriton School of Computer Science
External affiliations: Perimeter Institute (Affiliate)

Harvard University

Benjamin Pierce Fellow, Department of Mathematics, Sep 2016-Jun 2019 (on leave AY 16-17)
NSF MSPRF Postdoctoral Fellow, Department of Mathematics Sep 2017-Jun 2019

University of Toronto

NSF MSPRF Postdoctoral Fellow, Department of Mathematics, Sep 2016-Aug 2017

Research Interests

Probability, Mathematical Foundations of Data Science, Mathematical Physics

Awards and Honors

Canada Research Chair Tier II 2023-2028

Outstanding Paper Award, NeurIPS 2022

Golden Jubilee Research Excellence Award, University of Waterloo, 2022

NSF Mathematical Sciences Postdoctoral Research Fellowship, 2016-2019

NSF Graduate Research Fellowship, 2011-2016

Dean's Dissertation Fellowship, NYU GSAS, 2015-2016

Wilhelm Magnus memorial prize, NYU Courant, 2015

College of Arts and Sciences Dean's Award for Scholarship, NYU CAS, 2011

Perley Lenwood Thorne Medal in Mathematics, NYU Courant, 2011

George Granger Brown Scholarship for Physics, NYU CAS, 2010-2011

Phi Beta Kappa (US National Honours Society)

Grant record

Ontario Research Fund (PI), $ 80,000 CAD, 2024-2026

Canada Foundation for Innovation, John Evans Leaders' Fund, (PI), $80,000 CAD, 2024-2026

University of Waterloo, Mathematics Faculty Research Fund (PI), 2023–2028, $250,000 CAD

Canada Research Chairs Program, Federal Research Fund (PI), $100,000 CAD, 2023-2028

Canada Research Chairs Program, Canada Research Chair Tier II (PI), $500,000 CAD , 2023-2028

Natural Sciences and Engineering Research Council of Canada, Discovery Grant RGPIN-2020-04597 (PI) $165,000 CAD 2020-2025

Natural Sciences and Engineering Research Council of Canada, Discovery Launch Supplement, DGECR-2020-00199 (PI), $12,500 CAD 2020-2022

National Science Foundation (US) DMS 1854406 (PI), $150,000 USD, (*Declined* due to move to Waterloo)

National Science Foundation (US), Mathematical Sciences Postdoctoral Research Fellowship, OISE-1604232 (PI), $150,000 USD, 2016-2019

National Science Foundation (US), Graduate Research Fellowship, $99,000 USD 2011-2016

Research

Preprints and Publications

(Preprints Available at `http://math.uwaterloo.ca/~a3jagann/research.html`)
The following use the alphabetical authorship convention common to theoretical fields unless starred (*).

39. R. Gheissari, A. Jagannath, Y. Xu, Finding planted clique using Markov Chain Monte Carlo, *submitted* (2023) arXiv:2311.07540
38. D. Gamarnik, A. Jagannath, and E. Kizildag, Shattering in the Ising p-spin model. *submitted* (2023) arXiv:2307.07461
37. *K. Ramsay, A. Jagannath, and S. Chenouri, An elementary concentration bound for Gibbs measures arising in statistical learning theory, *submitted*
36. *K. Ramsay, A. Jagannath, and S. Chenouri, Differentially private multivariate medians, *submitted*, (2022) arXiv:2210.06459

35. A. Jagannath and P. Lopatto, Existence of the free energy of heavy-tailed spin glasses, Comm. Math. Phys. 405 no. 226 (2024)

34. D. Gamarnik, A. Jagannath, and A. Wein, Circuit lower bounds for the p-spin optimization problem, Markov Process. Related Fields (special issue for Inhomogeneous Random Systems 2022) 2024, v.30, Issue 1, 81-96

33. G. Ben Arous, R. Gheissari, J. Huang, and A. Jagannath, High-dimensional SGD aligns with emerging outlier eigenspaces. *International Conference on Learning Representation 12* (ICLR 2024) (spotlight), (2024)

32. D. Gamarnik, A. Jagannath, and A. Wein, Hardness of random optimization problems for boolean circuits, low-degree polynomials, and Langevin dynamics, SIAM Journal on Computing 53 no. 1 (2024) 1-46

31. G. Ben Arous, R. Ghessari, and A. Jagannath, High-dimensional limit theorems for SGD: effective dynamics and critical scaling, Communications on Pure and Applied Mathematics 77 (2024) 2030-2080. Conference version appeared at NeurIPS 2022 (Oustanding Paper Award)

30. G. Ben Arous and A. Jagannath, Shattering versus metastability in spin glasses, Comm. Pure Appl. Math., Vol 77, pp 139–176 (2024)

29. A Baranwal, K. Fountoulakis, and A. Jagannath, Optimality of Message-Passing Architectures for Sparse Graphs, *Advances in Neural Information Processing Systems 37* (NeurIPS 2023), 2023

28. *K. Fountoulakis, A. Levi, S. Yang, A. Baranwal, and A. Jagannath, Graph attention retrospective, J. Mach. Learn. Res., Vol 24, No. 246, 1-52 (2023) (Best paper award, ICLR GroundedML Workshop 2022)

27. A. Jagannath and N. Perkowski, A simple construction of the dynamical Φ^4_3 model, Trans. Amer. Math. Soc. Vol. 376, No. 3, pp 1507–1522 (2023)

26. A. Baranwal, K. Fountoulakis, and A. Jagannath, Effects of graph convolution on deep networks, *International Conference on Learning Representations 11* (ICLR 2023) (spotlight/notable-top-25%), (2023)

25. D. Gamarnik, A. Jagannath, and S. Sen, The overlap gap property in principal submatrix recovery, Probab. Theo. Relat. Fields 181, pp 757–814 (2021)

24. A. Baranwal, K. Fountoulakis, and A. Jagannath, Graph convolution for semi-supervised classification: Improved linear separability and out-of-distribution generalization, ICML 2021 (spotlight), Proc. Mach. Learn. Res. Vol 139, 684-693 (2021)

23. G. Ben Arous, R. Gheissari, and A. Jagannath, Online stochastic gradient descent on non-convex losses from high-dimensional inference, J. Mach. Learn. Res., Vol 22, No. 106, 1-51 (2021)

22. A. Jagannath and S. Sen, On the unbalanced cut problem and the generalized Sherrington-Kirkpatrick model, Ann. Inst. H. Poincaré Comb. Phys. Interact. 8 (2021), pp 35-88

21. D. Gamarnik and A. Jagannath, The overlap gap property and approximate message passing algorithms for p-spin models, Ann. Probab., Vol 49, No. 1 (2021), 180-205.

20. D. Gamarnik, A. Jagannath, and A.S. Wein, Low-degree hardness of random optimization problems, Proc. 2020 61st IEEE Symp. on Found. Comp. Sci (FOCS 2020) pp. 131-140. Full version: arXiv:2004.12063v1

19. A. Jagannath, P. Lopatto, and L. Miolane, Statistical thresholds for tensor PCA, Ann. Appl. Probab. (2020), Vol. 30, No. 4, 1910-1933

18. G. Ben Arous, R. Gheissari, and A. Jagannath, Algorithmic thresholds for tensor PCA, Ann. Probab., Vol. 48, No. 4 (2020), 2052-2087
17. G. Ben Arous, R. Gheissari, and A. Jagannath, Bounding flows for spherical spin glass dynamics, Commun. Math. Phys., 373, 1011-1048 (2020)
16. A. Jagannath, Dynamics of mean field spin glasses on short and long timescales, J. Math. Phys. 60, 083305 (2019) (special issue for ICMP 2018)
15. A. Auffinger and A. Jagannath, Thouless–Anderson–Palmer equations for generic p-spin glasses, Ann. Probab. 47 (2019), No. 4, 2230–2256
14. R. Ghessari and A. Jagannath, On the spectral gap of spherical spin glass dynamics, Ann. Inst. H. Poincaré Probab. Statist., Vol. 55, No. 2 (2019), 756-776.
13. A. Auffinger and A. Jagannath, On spin distributions for generic p-spin models, Jour. Stat. Phys. (2019) 174: 316
12. G. Ben Arous and A. Jagannath, Spectral gap estimates for mean field spin glasses, Commun. Math. Phys. (2018), Vol. 361, No. 1, pp 1-52
11. A. Jagannath, J. Ko, and S. Sen, MAX κ-CUT and the inhomogeneous Potts spin glass, Ann. Appl. Probab. (2018), Vol. 28, No. 3, 1536-1572
10. A. Jagannath and I. Tobasco, Bounding the complexity of replica symmetry breaking for spherical spin glasses Proc. Amer. Math. Soc., Vol. 146, No. 7, July 2018, pp 3127-3142
9. A. Jagannath and T. Trogdon, Random matrices and the New York City subway system, Phys. Rev. E 96, 030101(R), (2017)
8. A. Jagannath and I. Tobasco, Low temperature asymptotics in spherical mean field spin glasses, Commun. Math. Phys. (2017), Vol. 352, No. 3, pp 979-1017
7. A. Jagannath and I. Tobasco, Some properties of the phase diagram of mixed p-spin glasses, Probab. Theory Relat. Fields (2017) 167: 615-672.
6. A. Jagannath, Approximate ultrametricity for random measures with applications to spin glasses, Comm. on Pure and Appl. Math. 70 (2017), 611-664.
5. A. Jagannath, On the overlap distribution of branching random walks, Electron. J. Probab. (2016) Vol. 21, paper no. 50, 16 pp.
4. A. Jagannath and I. Tobasco, A dynamic programming approach to the Parisi functional, Proc. Amer. Math. Soc. (2016) Vol. 144, No. 7, pp 3135-3150
3. A. Jagannath, Variational and structural methods in mean field spin glasses, Ph. D. Thesis, May 2016
2. S. Heilman, A. Jagannath, and A. Naor, Solution of the propeller conjecture in $\mathbb{R}^3$, Disc. Comp. Geom., Vol. 50, No. 2 (2013), pp 263-305. (an extended abstract appeared at STOC 2012.)
1. A. Jagannath and H. Weitzner, Charged particle motion in electromagnetic fields varying moderately slowly in space, Phys Plasmas 18, 104510 (2011).

Invited talks and minicourses

46. 2nd ICML Workshop on High-dimensional Learning Dynamics, ICML, Vienna, July 2024
45. Computational complexity of Statistical Inference, BIRS, Feb 2024
44. Mathematics of Data Science, National University of Singapore, Singapore, Jan 2024

43. Machine Learning Theory Workshop, Vector Institute and University of Waterloo, Nov 2023
42. Analytical Approaches for Neural Network Dynamics. Institut Henri Poincaré, Paris, Oct 2023
41. High Dimensional Statistics and Random Matrices, Porquerolles, June 2023
40. CanaDAM, Winnipeg, June 2023
39. Optimization in data science, SIAMOPT, Seattle May 2023
38. Mossel-Sun working group, MIT, April 2023
37. Probability seminar, MIT, April 2023
36. Topics in High Dimensional Probability, ICTS-TIFR, Bangalore, Jan 2023
35. Spin glass workshop, SwissMAP research centre, Les Diableret, Sept 2022
34. Inhomogeneous Random Systems 2022 (29th annual), Institut Curie and Institut Henri Poincaré, Paris, Jan 2022
33. Probability Seminar, University of Toronto, Dec 2021
32. Session on "Mathematical Foundations of Machine Learning", Canadian Mathematical Society Winter Meeting, Vancouver, Dec 2021
31. Montreal probability seminar, Centre de Recherche Mathématiques and McGill, Oct 2021
30. Statistics seminar, U.C. Davis, April 2021
29. Algorithms and Complexity seminar, University of Waterloo, September 2020
28. Youth in High Dimensions, International Centre for Theoretical Physics, July 2020
27. Online Open Probability School (prev. Séminaire de Mathématiques Supérieures, Centre de Recherche Mathematiques, 4 lectures) June 2020
26. Mathematical Methods and Models in Machine Learning, University of Bologna, April 2020
25. The rough high-dimensional landscape problem, Kavli Institute for Theoretical Physics, Feb. 2019
24. Probability seminar, MIT, November 2018
23. Math, Information, and Computation seminar, NYU Center for Data Science, November 2018
22. Math and Data working group, NYU Center for Data Science, November 2018
21. Stochastics and Statistics seminar, Institute for Data, Systems, and Society, MIT, October 2018
20. Spin glasses and related topics, Banff International Research Station, October 2018
19. Probability seminar, Cornell University, September 2018
18. Scaling limits in models of statistical mechanics, Oberwolfach, September 2018
17. Statistical physics and machine learning back together, Institut d'Etudes Scientifique de Cargese, August 2018
16. Session on Equilibrium statistical mechanics, International Congress of Mathematical Physics, Montreal, July 2018
15. Simons meeting on High-dimensional dynamics, Simons Collaboration on "Cracking the Glass Problem", CUNY, April 2018 (Keynote speaker)
14. Dynamical systems seminar, Lefschetz Center, Brown University, April 2018
13. Probability seminar, University of Toronto, January 2018
12. First joint meeting of CRM-IMPA, Centre de Recherche Mathematiques, July 2017

11. Phase transitions in random computational problems, American Institute of Mathematics, June 2017
10. Analysis seminar, University of Toronto, March 2017
9. Probability seminar, Stanford University, February 2017
8. Analysis and probability seminar, University of Michigan, February 2017
7. Random matrix theory and probability seminar, Harvard University, February 2016
6. Probability seminar, Northwestern University, February 2016
5. Probability and statistical physics Seminar, University of Chicago, January 2016
4. Probability seminar, Cornell University, September 2015
3. Analysis Seminar, Northwestern University, June 2015
2. Doctoral student working group seminar of LPMA (Paris VI and VII), April 2015
1. Spin glasses and related topics, Banff International Research Station, July 2014

Academic Experiences and Synergistic Activities

Teaching

Students

Varnan Sarangian (PhD in Statistics, U. Waterloo, 2024–)

Taj Jones-McCormick (PhD in Statistics, U. Waterloo, 2023–)

Aseem Baranwal (PhD in CS U. Waterloo, 2020–)

Lily Seebach (MMath in Data Science, U. Waterloo, 2024–)

Parsa Rangariz (MMath in Statistics, U. Waterloo, 2023–)

Victor Issa (Masters' Intern, ENS Lyons, 2023 $\rightarrow$ PhD ENS Lyons)

Tingzhou Yu (MMath in Statistics, U. Waterloo, 2023 $\rightarrow$ PhD at U. Alberta)

Philipp Schröppel (MMath in Statistics, U. Waterloo, 2022 $\rightarrow$ Industrial PhD at Ulm U. CS)

Anna Brandenberger (MSc in Physics, Perimeter Institute 2022 $\rightarrow$ PhD at MIT Math)

Postdocs

Justin Ko (2023–)

Yiming Xu (2023–2024, $\rightarrow$ Asst. Prof. U. Kentucky)

University of Waterloo

Instructor: Stat 230–Probability Theory, Fall 2021; Stat 240–Probability Theory (advanced level), Fall 2019; Stat 333–Stochastic Processes 1, Winter 2020, Winter 2022; Stat 901–Theory of Probability 1 (Graduate), Fall 2021; Stat 902 – Theory of Probability 2 (Graduate), Winter 2024; Stat 946–Math of Data Science (advanced topics), Winter 2021,

PhD proposal committee: Takaai Koike (2019), Weinan Qi (2020), Kelly Ramsay (2020), Hongda Hu (2022)

PhD Defense: Sina Baghal (2021), Kelly Ramsay (2022), Jacob Campbell (2023)

External Examiner: Fu-Husan Ho (PhD in Math, Toulouse, 2023), Tomas Dominguez (PhD in Math, University of Toronto, 2023)

MMath Thesis committee: Varnan Sarangian (2023)

Harvard University

Instructor: Math 21a—Multivariable calculus (Undergraduate), Fall 2017; Topics In Mean Field Spin Glasses (Graduate), Spring 2018, Probability Theory, Spring 2019

PhD Defense: Benjamin Landon (chair and reader, 2018), Zilian Che (chair and reader, 2018)

New York University

Recitation Leader: Theory of Probability (Undergraduate), Spring 2014; Honors Analysis 1 (Undergraduate), Fall 2014, Fall 2015

Grader: Adv. Topics in Probab.: Random Graphs (Graduate), Spring 2016

Committees

University of Waterloo

communication 2019-2021, probability seminar (founder and chair) 2020–, programs 2023–

Harvard University

Brandies-Harvard-MIT-Northeastern colloquium AY 17-18, qualification exam AY 18-19

Seminar and Conference Organization

Co-organizer, Analysis of Complex Data: Tensors, Networks, and Dynamic Systems (24w5263), BIRS (Banff), Spring 2024

Organizer, Waterloo Probability Seminar, Winter 2020–

Organizer, Harvard-CMSA Random Matrix and Probability Theory Seminar, Fall 2017– Spring 2019

Organizer, Brandeis-Harvard-MIT-Northeastern Colloquium, Fall 2017– Spring 2018

Organizer, Toronto Probability Seminar, Fall 2016– Spring 2017

Organizer, Special Session on Spin Glasses and Disordered Media, JMM (AMS), Jan. 2017

Organizer, Courant Graduate Student Post-Doc Seminar (NYU) Spring 2014–Fall 2015

Organizer, Student Probability Seminar (NYU) Fall 2013–Spring 2016

Last updated: September 30, 2024